WASHINGTON STATE DEPARTMENT OF ECOLOGY

# Focus

## A Study of Dioxins in Washington's Agricultural Soils

### Background

The Washington State Department of Ecology studied metals and dioxins in the soils of our state in response to concerns about the potential effects of fertilizers and soil amendments made with recycled industrial waste products. These studies, intended to determine typical concentrations in Washington State soils, were previously released to the public with the exception of an assessment of typical dioxin concentrations in agricultural soils. Data on agricultural soils are now available, and the final report is now complete.

### Study results

The original study, *Screening Survey for Metals and Dioxins in Fertilizer Products and Soils in Washington State*, provided enough data about typical dioxin concentrations in Washington State soils to allow general comparisons among urban, forested and open lands. The addendum study, *Dioxins in Washington State Agricultural Soils,* shows lower levels of dioxins in agricultural soils than in any other type of soil tested.

### Dioxin concentrations in Washington State soils by land use

Reported as Toxic Equivalents (TEQ), parts per trillion. Non-detect samples given a value of zero.

| Land Use | Range | Average | Median | Geometric Mean* | Number of Samples |
|---|---|---|---|---|---|
| Urban | 0.13 – 19 | 4.1 | 1.7 | 1.9 | 14 |
| Forest | 0.033 – 5.2 | 2.3 | 2.2 | 1.2 | 8 |
| Open | 0.040 – 4.6 | 1.0 | 0.27 | 0.24 | 8 |
| **Agricultural** | **0.0078-1.2** | **0.14** | **0.054** | **0.062** | **54** |

*A geometric mean is similar to an average. In many environmental studies, including this one, a geometric mean is the best estimate of the central or most common value in a data set.



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Scientists are not certain why dioxin levels are so much lower in agricultural soils. The fact that farmlands usually are located far from urban sources of dioxins may contribute to lower levels. Tilling of agricultural land could be another factor because it may cause greater degradation and dilution of dioxins.

Study results indicate that dioxin concentrations in soils from open, forest and urban land in Washington are generally similar to those from several European countries. Ecology found no data for dioxins in agricultural soils in the United States that could be compared to the Washington state data, but Ecology did find studies from Germany and Russia. Based on very limited data, it appears that agricultural soils in Washington are lower in dioxin than are soils in those countries.

The Washington numbers also appear to compare favorably with the U.S. Environmental Protection Agency's estimated national average background level for dioxins of eight parts per trillion (8 ppt). However, a direct comparison is not accurate because methods used to gather the two sets of data were substantially different.

## Agricultural soils study design

Each of the 54 agricultural soil samples was a composite of 10 sub-samples collected from the soil surface to a depth of five centimeters, where airborne deposits of dioxins would normally be found. Sample sites were randomly selected to represent the distribution of Washington agricultural soils by crop acreage and region.

For the purposes of this study, the phrase *typical concentrations* means dioxin concentrations in surface soils distant from known or likely sources of these pollutants. Ecology chose the term *typical concentrations* because *background concentrations* implies natural conditions, and the extent to which these concentrations are natural is not clearly known.

## What are dioxin TEQs?

There are 17 forms of dioxins considered to be toxic, but not all are equally toxic. The most toxic dioxin is called 2,3,7,8-TCDD, and other similar dioxins have been assigned toxicity values relative to it. These relative toxicity values are called toxicity equivalency factors (TEFs). 2,3,7,8-TCDD is assigned a TEF of 1, and the others are assigned values less than 1. The concentration and TEF for each form of dioxin are then factored into a single value that represents the overall toxicity in the environment, expressed as TEQ (toxic equivalent).

## What will Ecology do with this information?

Ecology's goal is to keep Washington soils clean and reduce the amount of dioxins in the environment. To further this goal, Ecology is exploring the possibility of regulating the quantity of dioxins in fertilizers. Knowing the levels of dioxins in Washington State soils is useful because we can then determine how application of fertilizers or other activities are likely to effect these concentrations. They also help us understand where dioxins accumulate and will provide a base from which we will be able to evaluate changes in the future. The study information may also be used to help regulate industries and others that produce dioxin.

## For More Information

Contact Bill Yake, Department of Ecology Environmental Assessment Program, (360) 407-6778. For information in an alternative format, call Ron Langley at (425) 649-7009 (voice) or (425) 649-4259 (TDD).

For a copies of *Dioxins in Washington State Agricultural Soils*, Publication Number 99-333 or *Screening Survey for Metals and Dioxins in Fertilizer Products and Soils in Washington State*, Publication number 99-309, contact the Ecology Publications Office at (360) 407-7472 or via e-mail at ecypub@ecy.wa.gov. Electronic copies of these reports are available at http://www.wa.gov/ecology/biblio/99333.html and http://www.wa.gov/ecology/biblio/99309.html.